

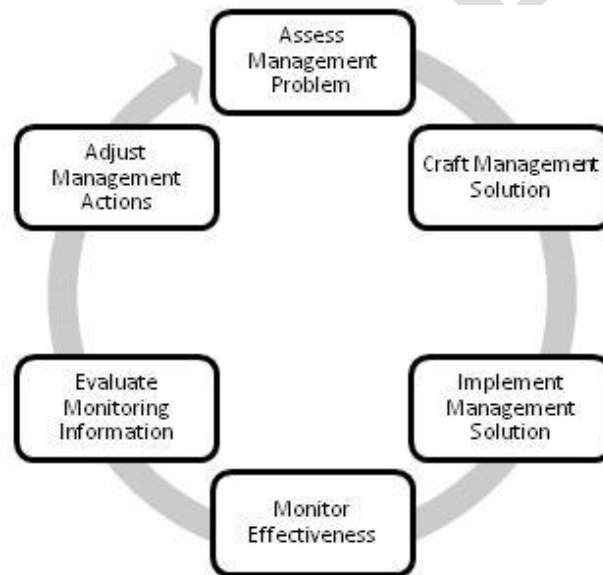
Chapter 6. Monitoring and Evaluation

Introduction

Monitoring and evaluation are separate and sequential activities required by National Forest Management Act regulations to determine how well the Forest Plan is working. Monitoring¹ involves collecting data by observation or measurement. Evaluation involves analyzing and interpreting monitoring data.

Monitoring and evaluation activities provide on-going feedback about management effectiveness and are essential elements of an adaptive management cycle that includes problem identification, solution, and implementation (figure 6-1). Monitoring and evaluation activities keep direction found in the Forest Plan up-to-date and relevant by being responsive to changing conditions and issues, including public desires, and to new information, such as research results or outcomes from management activities.

Figure 1. Monitoring and evaluation are elements of an “adaptive” management cycle.



Monitoring Strategy

A strategy for Forest Plan monitoring and evaluation has been designed to answer these three basic questions:

¹ The general purpose of monitoring is to detect changes or trends in a resource. Detection of a change or trend may trigger a management action, or it may generate a new line of inquiry. Monitoring data are most useful when the same methods are used to collect data at the same locations over time. It is important to note that cause and effect relationships usually cannot be demonstrated with monitoring data, but monitoring data might suggest a cause and effect relationship that can then be investigated with a research study.

- 1) **Did we do what we said we were going to do?** The answers to this question should tell us how well the direction in the Forest Plan is being implemented. Collected information is compared to objectives, standards, guidelines, and management area direction.
- 2) **Did it work how we said it would?** The answers to this question should tell us whether the application of standards and guidelines is achieving objectives, and whether objectives are achieving desired conditions.
- 3) **Is our understanding and science correct?** The answers to this question should tell us whether the assumptions and predicted effects used to formulate the desired conditions and objectives are valid.

The following guiding principles are key elements of the Prescott NF's monitoring strategy and serve as a framework for implementing an effective monitoring and evaluation program:

- Monitoring efforts are efficient, practical and affordable; make use of the best available science; and do not duplicate the collection of data already underway for other purposes.
- Monitoring tasks are scaled to the desired condition, objective, or management area direction to be monitored. Data that is collected for other purposes, but can also answer monitoring questions herein, are identified, compiled, and evaluated as part of the monitoring report.
- Monitoring considers effects of management on FS lands and resources as well as adjacent lands and communities. Monitoring results from adjacent non-FS lands are reviewed to identify how threats and resources may be crossing boundaries, and how pressures and management of surrounding lands may impact resources or activity on FS lands.
- Opportunities to complete monitoring and evaluation activities through partnerships and citizen collaboration are examined on a regular and on-going basis.
- Monitoring is not performed on every single activity, nor does it need to meet the statistical rigor of formal research.
- A monitoring action plan is prepared initially and updated regularly. The monitoring action plan identifies and schedules various site-specific, on-the-ground monitoring activities. It also describes the methods, locations, responsible persons, and estimated costs. Budgetary constraints may affect the level of monitoring that can be done in a particular fiscal year. If budget levels limit the Prescott NF's ability to perform all monitoring tasks, then those items specifically required by law are given the highest priority (e.g., items in table 3).
- A monitoring and evaluation report is prepared each year that summarizes the results of completed monitoring and evaluates the data for indicators of trends or effects.
- The forest supervisor annually evaluates the monitoring information displayed in the evaluation reports through a management review and determines if any changes are needed in management actions or the Plan itself.
- The public is given timely, accurate information about Forest Plan implementation. This is done through the release of the annual monitoring and evaluation report.

The specific monitoring questions and performance measures that should be used to evaluate movement toward Forest Plan desired conditions under this monitoring strategy are displayed below in tables 3 through 8 and arranged according to six monitoring themes:

- Legally Required Monitoring

- Conserving Biological Diversity
- Retaining Ecosystem Resilience
- Maintaining Watershed, Soil and Air Quality
- Sustaining Recreational and Social Benefits
- Maintaining Infrastructure Capacity

In some cases, the monitoring question and performance measures directly assess accomplishment of desired conditions. In other cases, they gauge objectives or guidelines associated with the desired conditions.

For each monitoring question/performance measure listed in tables 3 through 8, additional monitoring descriptors are included to provide context for the type of information to gather and how often to gather it. These descriptors are defined here:

- **Frequency of Monitoring:** Describes how often information is gathered or measured such as annually, every three-five years, or every ten years.
- **Frequency of Evaluation:** Defines how often the information is analyzed and reported. Depending upon the monitoring question, analysis of the information may occur at longer time intervals than the frequency of monitoring.
- Some resources need to be monitored annually to produce trend data. Annually gathered data may be analyzed periodically (3, 5 or 10-year cycle), depending upon the timeframe specified by each objective.
- **Data Precision and Reliability:** Precision refers to how close the repeated measurements of the same quantity are to each other. Accuracy is a measure of how close a measurement is to the actual value of the variable being measured.
- Two categories of precision and reliability are appropriate at the Forest Plan scale:
- **Class A:** Methods generally are well accepted for modeling or quantitative measurement. Results have a high degree of repeatability, reliability, accuracy and precision.
- **Class B:** Methods or measurements are based on project records, personal communications, ocular estimates, pace transects, informal visitor surveys and similar types of assessments. The degree of repeatability, reliability, accuracy and precision are not as high as Class A methods, but they still provide valuable qualitative information.

Theme 1 – Legally Required Monitoring (from *1982 Planning Rule Section 219*)**Table 1. Prescott Forest Plan Monitoring Questions (Theme 1)**

| Action, Effect or Resource to be Measured | Monitoring Question | Performance Measure | Monitoring Frequency | Evaluation/ Reporting Frequency | Data Precision/ Reliability |
|---|--|---|----------------------|---------------------------------|-----------------------------|
| Comparison between estimated and actual Plan objectives (Section 219.12(k)(1)) | Are we achieving Plan objectives within the estimated ranges? | Proportion of objectives accomplished | Annually | Annually | A |
| Plan objectives, standards, and guidelines (Section 219.12(k)(2)) | Are the effects of Forest management resulting in significant changes to productivity of the land? | Changes in watershed condition class (HUC 6 level) | Annually | Every 5 years | A |
| Comparison of actual and estimated costs of activities estimated in Plan objectives (Section 219.12(k)(3)) | How close are projected costs with actual costs? | Dollars | Every 10 years | Every 10 years | A |
| Lands not suited for timber production (Section 219.12(k)(5)(ii)) | Have areas classified as unsuited for timber production become suitable? | Amount of unsuited versus suitable acres | Every 10 years | Every 10 years | A |
| Maximum size of openings from even-aged management (Section 219.12(k)(5)(iii)) | What percentage of openings created from even-aged management are 40 acres or less? | Percentage of harvest units | Every 5 years | Every 5 years | A |
| Destructive insects and disease ² (Section 219.12(k)(5)(iv)) | To what extent are undesirable outbreaks of insects and pathogens occurring within the Plan area? | Acres of infestation and tree mortality | Annually | Annually | A |
| Population trends of the Management Indicator Species in relation to habitat changes (Section 219.19(a)(6)) | As a proxy for population, what are the trends in habitat for Management Indicator Species within the Plan area? | MIS habitat attributes; MIS occurrence & distribution | Annually | Every 5 years | A |

² This item also meets the monitoring intent of Theme 3 – Retaining Ecosystem Resilience

Theme 2 – Conserving Biological Diversity

Table 2. Prescott Forest Plan Monitoring Questions (Theme 2)

| Action, Effect or Resource to be Measured | Monitoring Question | Performance Measure | Monitoring Frequency | Evaluation/Reporting Frequency | Data Precision/Reliability |
|--|--|---|---|--------------------------------|----------------------------|
| Vegetation Diversity (O-1,O-2,O-3,O-4,O-5,O-6, DC-Veg-1) | What are the current condition and trend of key characteristics for vegetation identified in the desired conditions for the plan area? | Vegetation size class, percent canopy cover, Composition; Acres of treatment by treatment type | Every 5years | Every 5 years | A |
| | How effective are management actions at maintaining or making progress toward desired conditions for the key characteristics of vegetation within the plan area? | | | | |
| Species Diversity (O-1,O-2,O-3,O-4,O-5,O-6, O-25,O-26,O-27,O-28, DC-Ecosystem Resilience-1,DC-Wildlife-1) | To what extent are management activities providing ecological conditions to maintain habitat for viable populations of native and desired non-native species? | Habitat acres treated; Miles of fence modified; Number of water developments improved; Species surveys (e.g., fish, herpes, breeding birds, bats, etc.) | Every 1 to 5 years depending on species | Every 5 years | A |
| Aquatic Species (O-24) | Are management actions maintaining or making progress toward desired habitat conditions for native fish, amphibian and reptile species? | Aquatic habitat quality; stream miles improved | Every 1 to 5 years depending on species | Every 5 years | A |
| Federally Listed Species (DC-Ecosystem Resilience-1) | Have conservation actions or conservation strategies for federally listed species been implemented? | Number of plans or actions initiated | Every 1 to 5 years depending on species | Every 5 years | A |
| | What are the habitat trends for Federally Listed species on the Prescott NF? | Habitat attributes | | | |

Theme 3 – Retaining Ecosystem Resilience

Table 3. Prescott Forest Plan Monitoring Questions (Theme 3)

| Action, Effect or Resource to be Measured | Monitoring Question | Performance Measure | Monitoring Frequency | Evaluation/Reporting Frequency | Data Precision/Reliability |
|---|---|---|----------------------|--------------------------------|----------------------------|
| Non-native Invasive Plant Species (O-6) | What are the status and trend of areas infested by invasive plant species? | Acres of invasive species surveyed; Acres of infestation treated | Annually | Every 5 years | A |
| Fire (O-1,O-2,O-3,O-4,O-5) | Are management actions moving fire regimes towards desired conditions? | Acres treated by fire severity level and frequency | Annually | Every 5 years | A |
| | To what extent is wildland fire used to maintain desired fuel levels and vegetation characteristics? To what extent is unwanted wildfire on the landscape suppressed? | Acres of fire managed for multiple objectives; Acres of unwanted fire suppressed; post-fire fuel loadings | | | |
| | To what extent is prescribed fire used to maintain desired fuel levels, and/or mirror natural processes, and or restore desired vegetation characteristics? | Acres of prescribed fire by fuel type; post-fire fuel loadings; vegetation species structure and density | | | |
| | Has the risk for active crown fire been sufficiently reduced in fire-adapted ecosystems where crown fires were not frequent occurrences historically? | Predicted fire behavior by fuel type/loading | | | |
| | To what extent are extreme weather patterns (e.g., precipitation and air temperature) affecting fire season length and severity? | Monthly/daily Energy Release Component (ERC) estimates by fuel type | | | |

| Action, Effect or Resource to be Measured | Monitoring Question | Performance Measure | Monitoring Frequency | Evaluation/Reporting Frequency | Data Precision/Reliability |
|---|---|--|----------------------|--------------------------------|----------------------------|
| Ecosystem Resilience (DC-Ecosystem Resilience-1) | What management actions, measures, or decisions are the Forest Service taking to enhance ecosystem resilience in response to changing environmental conditions? | Project-level design features or mitigations | Every 5 years | Every 5 years | A |

Theme 4 – Maintaining Watershed, Soil, and Air Quality

Table 4. Prescott Forest Plan Monitoring Questions (Theme 4)

| Action, Effect or Resource to be Measured | Monitoring Question | Performance Measure | Monitoring Frequency | Evaluation/Reporting Frequency | Data Precision/Reliability |
|---|---|---|----------------------|--------------------------------|----------------------------|
| High priority watersheds (O-18) | Are management actions being implemented to improve watershed conditions? | Number of projects implemented | Annually | Annually | A |
| Watershed features (O-19, O-23) | Are management actions being implemented to improve conditions of at-risk riparian areas, seeps, and springs? | Number of projects implemented | Annually | Annually | A |
| Watershed integrity (O-20, O-21,O-22) | Are management actions being implemented to reduce negative impacts to watershed conditions? | Miles of roads, routes, or trails repaired or improved | Annually | Annually | A |
| | | Number of improved drainage crossings | Annually | Annually | A |
| Airshed conditions (DC-airshed-1) | Are management activities contributing or responding to air quality effects on human health or human enjoyment? | Particulate Matter (PM 2.5) recorded at smoke sensitive sites | Annually | Annually | A |
| | Are air quality related values of Sycamore Canyon and Pine Mountain Wilderness Areas being maintained? | Visibility using (IMPROVE) program | Annually | Every 5 years | A |

Theme 5 – Sustaining Recreational and Social Benefits

Table 5. Prescott Forest Plan Monitoring Questions (Theme 5)

| Action, Effect or Resource to be Measured | Monitoring Question | Performance Measure | Monitoring Frequency | Evaluation/Reporting Frequency | Data Precision/Reliability |
|--|---|--|----------------------|--------------------------------|----------------------------|
| Diverse Recreation Experiences (O-7, O-8,O-10,O-13,O-14,O-16) | How many new recreation sites or locations have been added to the system? | Number of facilities or sites, INFRA | Annually | Every 5 years | A |
| | How many recreation sites or locations have been improved, relocated or decommissioned in response to known resource damage? | | | | |
| | Does the number of recreation opportunities limit overcrowding, reduce user conflicts, and minimize resource damage? | User satisfaction surveys (NVUM) | Every 5 years | Every 5 years | A |
| | Does the range of recreation experiences consider population demographic characteristics and desires of the local communities? | | | | |
| | To what extent are visitor information opportunities/ education activities being provided to the public? | Number and type of visitor information and education activities | Annually | Annually | B |
| Eligibility for Wild/Scenic Rivers (DC-Wild & Scenic-1) | Has there been adequate protection of outstandingly remarkable values (ORVs) of river segments that are eligible for Wild/Scenic River designation? | Changes to ORVs | Every 5 years | Every 5 years | B |
| Eligibility for Wilderness Designation (DC-Wilderness-1) | Has there been adequate protection of wilderness characteristics of areas that are eligible for wilderness designation? | Changes to wilderness character | Every 5 years | Every 5 years | B |
| Land Adjustment (DC-Open Space-1, DC-Lands-1, O-29) | To what extent is the Prescott NF land adjustment program supporting or enhancing Forest Plan desired conditions (open space, scenery values)? | Area of land adjustment that meets community open space needs and provides for natural resource values | Every 5 years | Every 5 years | B |

Theme 6 – Maintaining Infrastructure Capacity

Table 6. Prescott Forest Plan Monitoring Questions (Theme 6)

| Action, Effect or Resource to be Measured | Monitoring Question | Performance Measure | Monitoring Frequency | Evaluation/ Reporting Frequency | Data Precision/ Reliability |
|--|--|---|----------------------|---------------------------------|-----------------------------|
| Roads, Trails, and Facilities (O-9, O-11, O-12, O-15, O-17) (DC-Transportation & Facilities-1) | How many miles of the designated roads and trails are maintained to standard? | Miles of roads and trails | Annually | Annually | A |
| | How many developed and designated recreation sites are being maintained? | Percentage of sites maintained | Annually | Annually | A |
| | What proportion of trailheads and wilderness boundaries are adequately signed or marked? | Percentage of total trailheads; Miles of wilderness boundary | Annually | Every 5 years | A |